ARM - ACP AEROSOL IOP
Surface Measurements for Chemical - Microphysical - Optical Closure Experiments

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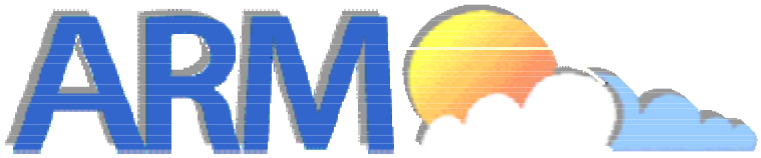
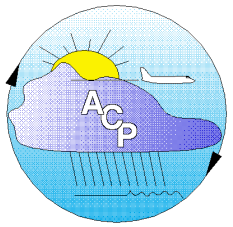




ARM Aerosol IOP Planning Meeting

NASA Ames Laboratory

Mountain View CA

11 December 2002

THE HOLY GRAIL (Aerosol direct effect)

Sources of Aerosols & Precursors $f(x,y,z,t)$

↓ Chemical transport models

Aerosol Loading & Properties $f(x,y,z,t)$

↓ Mie scattering etc. models

Aerosol Optical Properties $f(x,y,z,t)$

↓ Radiation transfer models

Aerosol Radiative Influence $f(x,y,z,t)$

These models must be evaluated!

THE HOLY GRAIL (Aerosol indirect effect)

Sources of Aerosols & Precursors $f(x,y,z,t)$

↓ Chemical transport models

Aerosol Loading & Properties $f(x,y,z,t)$

↓ Köhler etc. models

CCN (Supersaturation) $f(x,y,z,t)$

↓ Cloud models

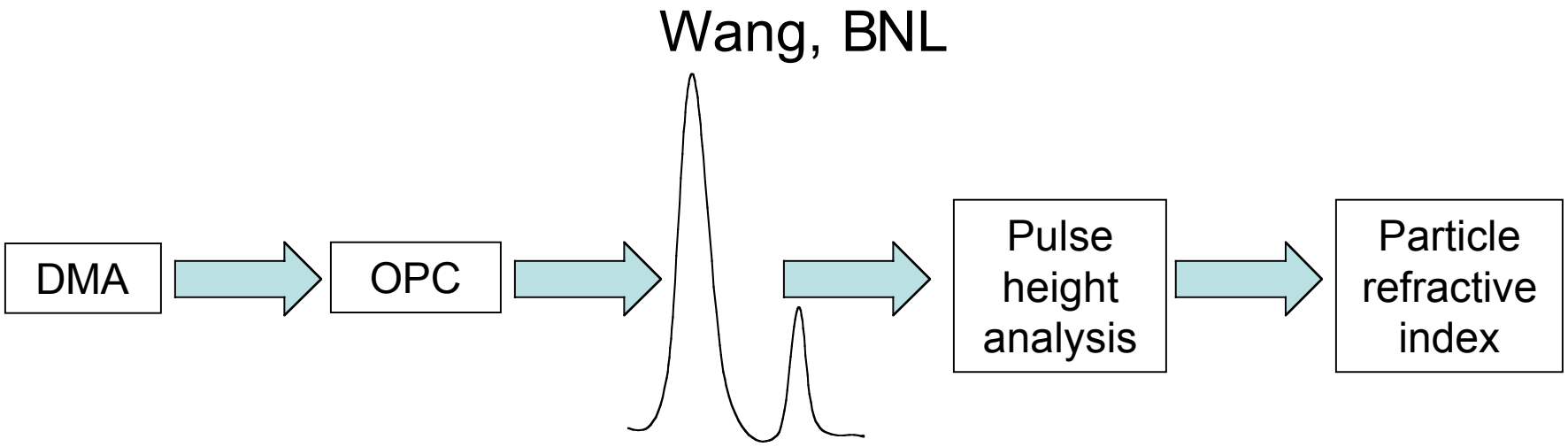
Cloud droplet concentration $f(x,y,z,t)$

↓ Radiation transfer models

Radiative Influence $f(x,y,z,t)$

These models must be evaluated!

Refractive Index and Hygroscopicity Measurement



Data will be used for:

- Calculation of aerosol optical properties

Tandem Differential Mobility analyzer system:

- Hygroscopic properties
- Mixing state

Chemical Composition Measurement

- PILS (Lee), Quantitative, possibly generate size resolved chemical composition by using different inlet size cuts.
- Total Organic Carbon (Lee)
- AMS (Aerodyne?? PNNL??), Size resolved chemical composition. Not as quantitative as PILS.
- OC-EC Analysis (Kirchstetter)
- Aerosol ionic composition (Routine measurement at CART site)

Aerosol Optical Properties Measurements

- Aerosol scattering (Neph) at 3 wavelengths (<1, 10 μm)
- Green light scattering as f(RH)

- Aerosol absorption (PSAP)
- Aerosol absorption: Photoacoustic

- Aerosol extinction: Cavity Ringdown
- Aerosol extinction: Folded Path

Closure Experiments

- Local optical properties closure:
  - Refractive index from chemical composition vs OPC
  - Size distribution & refractive index --> σ_{sp}
  - Scattering at 3 wavelengths
  - Absorption coefficient
  - Extinction coefficient
- Hygroscopic closure:
  - Chemical composition & size distributions
  - Growth factor from TDMA
  - Light scattering f(RH)
- Mass closure:
  - Size distribution
  - Density from composition
  - Mass from TEOM
- CCN closure:
  - Size distribution, chemical composition, and growth factor from TDMA
  - CCN spectrum

Composition Measurements
PILS (Particle Into Liquid Sampler)
Y.-N. Lee, BNL

Determination of major aerosol ions by ion chromatography

Determination of total aerosol organic carbon by UV/chemical oxidation and measurement of resultant evolved CO_2

Results are used to calculate water uptake and index of refraction f(RH).

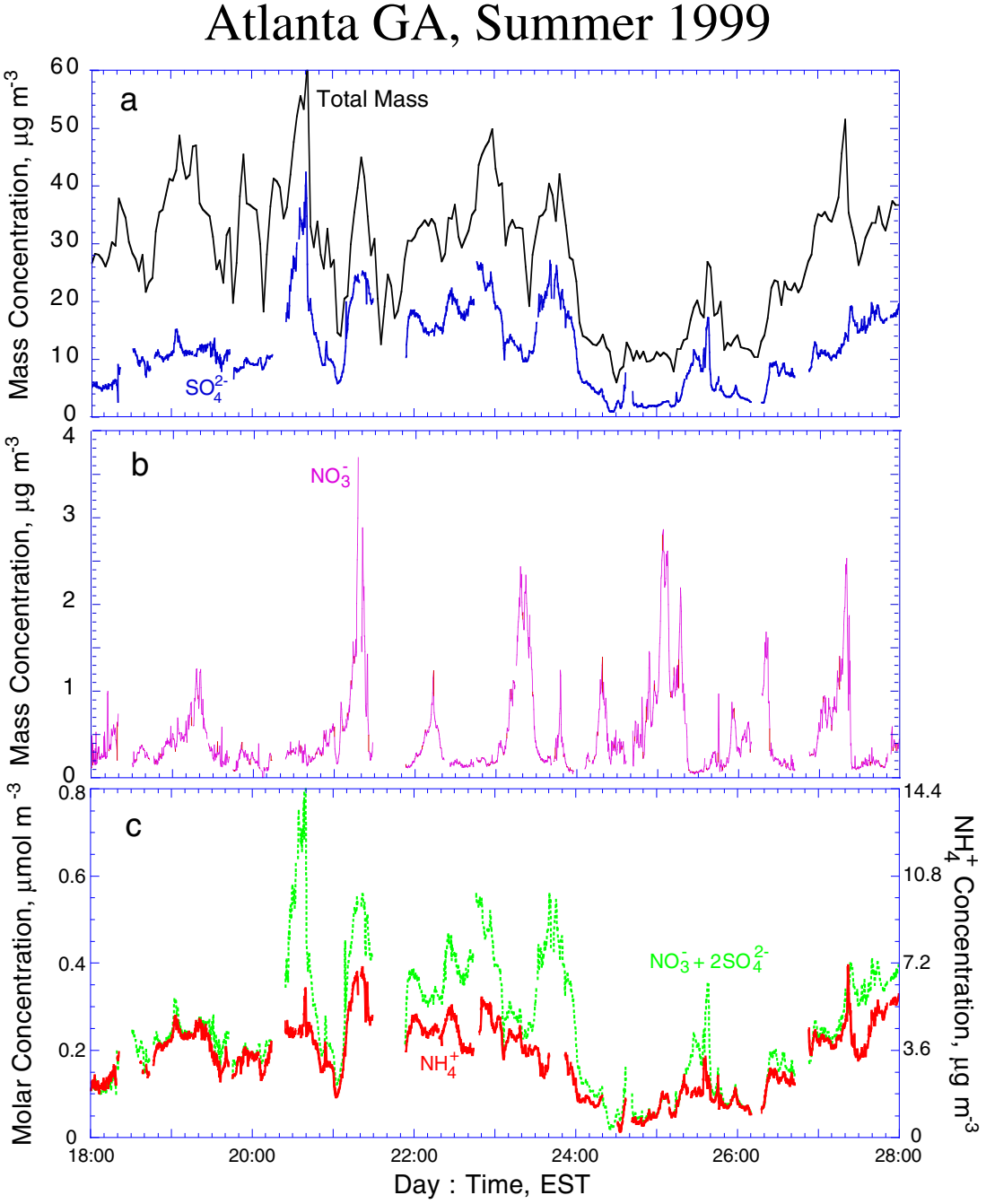
RAPID AND CONTINUOUS DETERMINATION OF AEROSOL COMPOSITION AND MASS

Y-N Lee, BNL

Major Ions

Total Organic Carbon

Particle Mass by TEOM



MEASUREMENTS OF KEY AEROSOL CHEMICAL AND MICROPHYSICAL PROPERTIES

- Major inorganic ions and total organic carbon - 7 min - PILS - Lee - BNL
- Particle Mass - Continuous - TEOM - Lee - BNL
- Black and organic carbon - Kirchstetter - LBL
- Particle size distribution; dry and f(RH) - Wang - BNL